New England Common Assessment Program

Practice Test Support Materials 2008

Grade 11 Science

Grade 11 Science Practice Test Item Information

Practice Test Item Number	1	2	3	4	5	6	7	8	9	10	11
Big Idea[1]	POC	NOS	POC	POC	SAE	INQ	POC	NOS	INQ	SAE	NOS
Assessment Target	PS1.3	PS1.2	PS3.9	ESS1.1	ESS3.7	ESS1.4	LS1.1	LS3.6	LS2.3	LS2.3	ESS3.6
Depth of Knowledge Code	2	2	1	2	1	2	2	1	2	2	2
Item Type[2]	MC	MC	MC	MC	MC	MC	MC	MC	MC	CR	CR
Answer Key	C	A	A	D	A	D	D	B	D		
Total Possible Points	1	1	1	1	1	1	1	1	1	4	4

[1]Big Idea: NOS = Nature of Science, SAE = Systems and Energy, MAS = Models and Scale, POC = Patterns of Change, FAF = Form and Function, INQ = Scientific Inquiry

[2]Item Type: MC = Multiple Choice, CR = Constructed Response

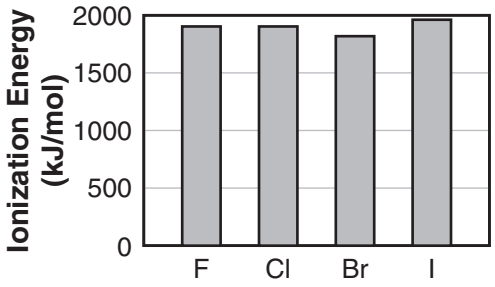
PS1.3 (9–11) POC	Students will explain how properties of elements and the location of elements on the periodic table are related.

Please use the periodic table on the reference sheet to answer the question.

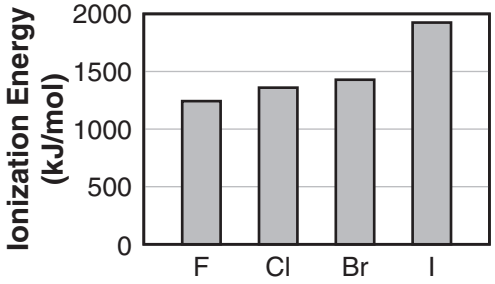
1 Ionization energy is the energy required to remove electrons from atoms. Fluorine (F), chlorine (Cl), bromine (Br), and iodine (I) are found in the halogen family in the periodic table.

Which graph shows the correct trend for the first ionization energy of these four elements?

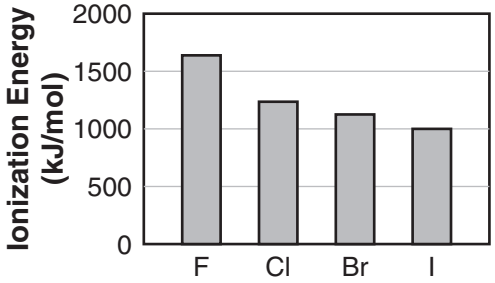
A.



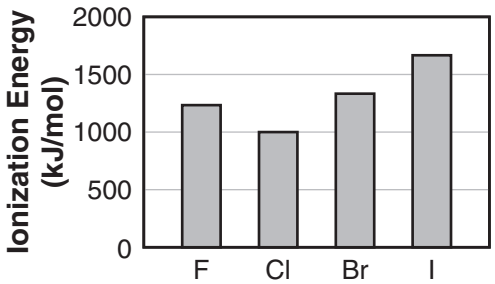
B.



C.



D.



PS1.2 (9–11) NOS Scientific thought about atoms has changed over time. Students will, using information (narratives or models of atoms) provided, cite evidence that has changed our understanding of the atom and the development of atomic theory.

2 Which statement provides the **best** evidence of wave-like behavior in electrons?

A. An electron beam demonstrates diffraction when passing through small openings.

B. An electric burner glows orange when heated with electricity.

C. Ultraviolet light striking a copper (Cu) plate produces a photoelectric effect.

D. Electrons are deflected by the poles of a magnet.

PS3.9 (9–11) POC Students will apply the concepts of inertia, motion, and momentum to predict and explain situations involving forces and motion, including stationary objects and collisions.

3 A student is on a train traveling at 60 miles per hour. The student places a basketball on the floor. The basketball remains motionless until the train's brakes are suddenly applied.

Which statement describes the motion of the basketball when this occurs?

A. The basketball moves forward because it is now moving faster than the train.

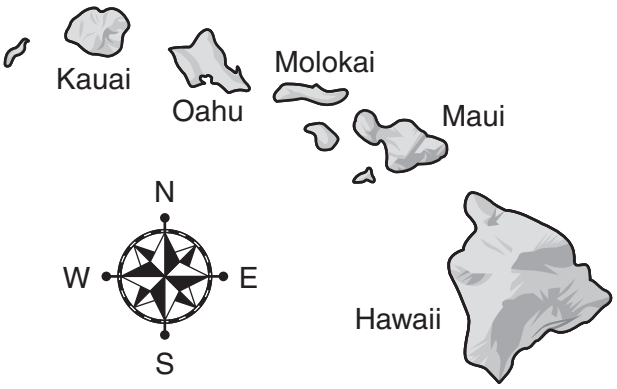
B. The basketball moves forward because it is now moving slower than the train.

C. The basketball moves backward because it is now moving faster than the train.

D. The basketball moves backward because it is now moving slower than the train.

ESS1.1 (9–11) POC Students will, provided with geologic data (including movement of plates) on a given locale, predict the likelihood for an Earth event (e.g., volcanoes, mountain ranges, islands, earthquakes, tides, tsunamis).

4 The Hawaiian Islands are younger on the eastern end than on the western end of the chain.



What is causing the age differences among the islands?

A. Two crustal plates are colliding.

B. A divergent boundary exists in the ocean floor.

C. An ocean plate is moving southeast across a hot spot.

D. An ocean plate is moving northwest across a hot spot.

ESS3.7 (9–11) SAE Students will, based on the nature of electromagnetic waves, explain the movement and location of objects in the universe or their composition (e.g., redshift, blueshift, line spectra).

5 Andromeda is the only known galaxy moving toward Earth at a speed of about 300 km/s. How was this information about Andromeda determined?

A. by measuring the blueshift of its spectral lines

B. by measuring the redshift of its spectral lines

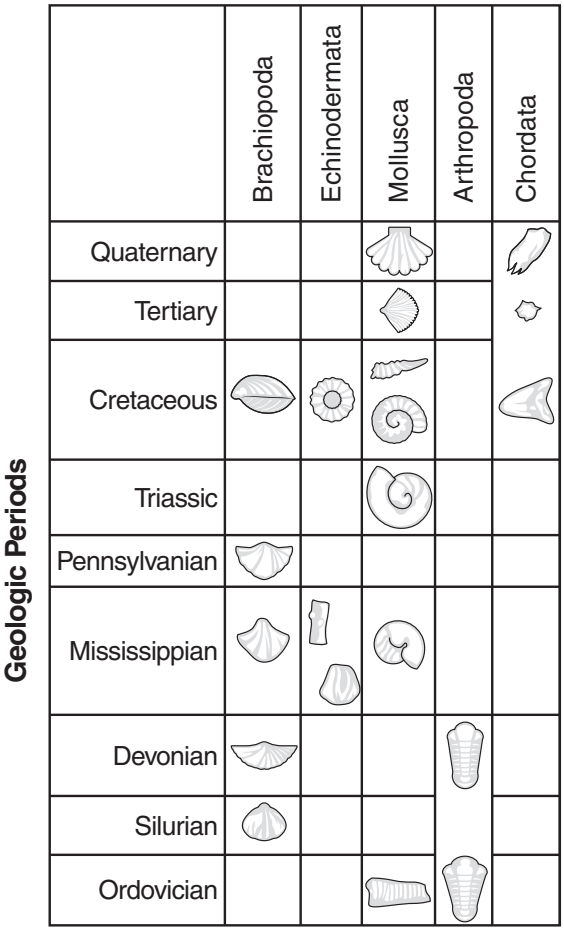
C. by measuring the widths of its spectral lines

D. by measuring the distance between its spectral lines

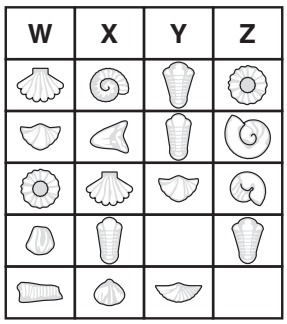
ESS1.4 (9–11) INQ Students will relate how geologic time is determined using various dating methods (e.g., radioactive decay, rock sequences, fossil records).

6 The diagram below shows index fossils from different geologic time periods.

Index Fossils



Based on the diagram, which fossil arrangement is in sequential geologic order?



A. W
B. X
C. Y
D. Z

LS1.1 (9–11) POC	Students will use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multicellular organism needs for survival (e.g., protein synthesis, DNA replication, nerve cells).

7 The table below shows the amounts of adenine, cytosine, and guanine found in a sample of nucleic acid.

Nucleic Acid Sample

Nitrogenous Base	Percent of Number of Molecules
Adenine	41%
Cytosine	32%
Guanine	16%

Which statement **best** explains whether the sample of nucleic acid is DNA or RNA?

A. The sample is DNA because the amounts of adenine and cytosine are approximately equal.

B. The sample is RNA because the amounts of adenine and cytosine are approximately equal.

C. The sample is DNA because the amounts of cytosine and guanine do not have to be equal.

D. The sample is RNA because the amounts of cytosine and guanine do not have to be equal.

LS3.6 (9–11) NOS Students will explain how evidence from technological advances supports or refutes the genetic relationships among groups of organisms (e.g., DNA analysis, protein analysis).

8 All kingdoms of living things can be placed in one of three larger classification groups called domains. Which cell component is found in all three domains of living things?

A. cell wall

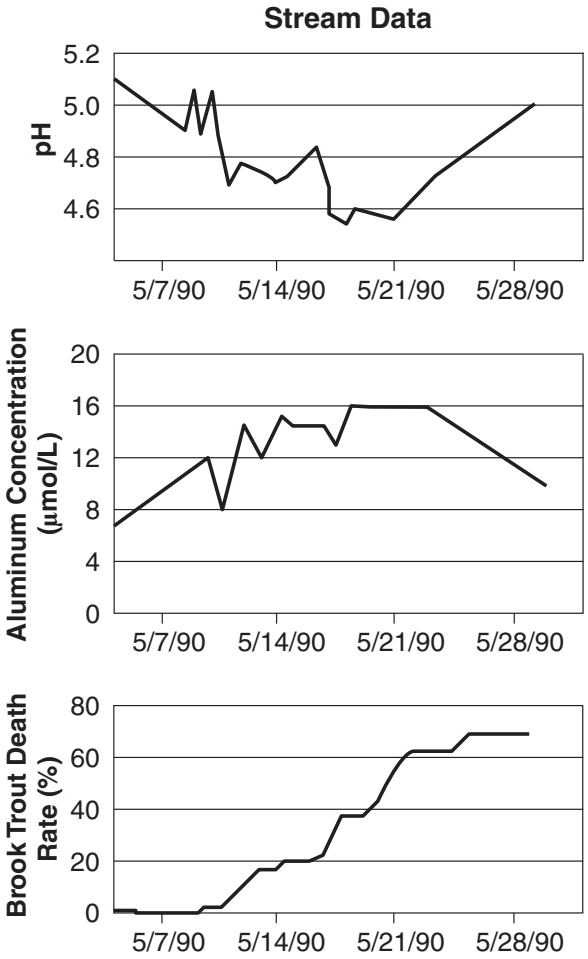
B. ribosome

C. nucleus

D. mitochondria

LS2.3 (9–11) INQ	Students will, using data from a specific ecosystem, explain relationships or make predictions about how environmental disturbance (human impact or natural events) affects the flow of energy or cycling of matter in an ecosystem.

9 The graphs below show data about a stream taken over a period of four weeks. The pH, dissolved aluminum concentration, and death rate of brook trout were measured.



Based on the information in the graphs, which question would be **best** for further scientific investigation?

A. Do brook trout die as pH and aluminum concentration decrease?

B. Do brook trout use the dissolved aluminum in the water?

C. Are brook trout responsible for the changes in pH in the stream?

D. Are brook trout more sensitive to aluminum than to low pH?

LS2.3 (9–11) SAE	Students will, using data from a specific ecosystem, explain relationships or make predictions about how environmental disturbance (human impact or natural events) affects the flow of energy or cycling of matter in an ecosystem.

10 The diagram below shows the flow of energy in a temperate deciduous forest.

Oak tree **Squirrel** **Hawk**

a. Which organism is capable of transforming solar energy into chemical energy? Explain your answer.

b. Which organism is **least** efficient at capturing energy? Explain your answer.

c. Deforestation is the removal of trees by cutting or burning. How would deforestation affect the flow of energy among the trophic levels represented in the diagram?

Scoring Guide

Score	Description
4	Response demonstrates a thorough understanding of ecological relationships and making predictions about how environmental disturbances affect the flow of energy in an ecosystem. Response completes all tasks required by identifying the oak tree as most efficient and explaining why, identifying the hawk as least efficient and explaining why, and stating that energy flow is disrupted after deforestation.
3	Response demonstrates a general understanding of ecological relationships and making predictions about how environmental disturbances affect the flow of energy in an ecosystem. The response has an error or omission.
2	Response demonstrates a limited understanding of ecological relationships and makes predictions about how environmental disturbances affect the flow of energy in an ecosystem. The response has errors and omissions.
1	Response demonstrates a minimal understanding of ecological relationships and makes predictions about how environmental disturbances affect the flow of energy in an ecosystem. The response has several errors and omissions.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Training Notes:

a. The tree is capable of converting solar energy to chemical energy by the process of photosynthesis.

b.
- The hawk is the least efficient at capturing energy because only one percent of the energy converted by plants actually reaches the hawk. The energy is used or lost as heat before it reaches the hawk.
- The hawk uses more energy to capture prey/energy for its use.

c.
- Destruction of trees reduces photosynthesis, so energy originally entering the system is lost. Therefore, all organisms (squirrels and hawks) directly or indirectly receiving energy from trees will either die or move to new areas.
- Organisms will have to find an abundant, different food source.
- Since most organisms have more than one food source, it may have little effect.

Special Notes:

- Score holistically.
- If part (a) response contains "tree" and part (b) response contains "hawk," give 1 point total for parts (a) and (b).
- Give full credit in part (a) if response also explains photosynthesis, in part (b) if response explains how energy is reduced at each trophic level and less energy is passed on to the next, and in part (c) if response fully explains how energy lost at the producer level will affect all other levels.

SCORE POINT 4

10

a) The oak tree transforms solar energy into chemical energy through photosynthesis. It is a plant, so it uses chlorophyll to photosynthesize the sun's rays.

b) The hawk is least efficient at capturing energy. It can only recieve 10% of the energy that the squirrell recieves from eating plants, and the squirrell, in turn only recieves 10% of the trees energy.

c) Deforestation would affect every trophic level. If there were fewer trees, the squirrells would have less food and their population would decrease. As the squirrell population decreased, the hawks would not be able to find food, and its population would be depleted.

The response is complete and includes all required elements. The oak tree is correctly identified as the primary producer, and the response notes that photosynthesis is the process involved. There is strong use of detail. Part (b) receives full credit for identifying the hawk as the least efficient in capturing energy. The response also gives a detailed explanation of energy loss through the trophic levels. Finally, the response gives a thorough, accurate explanation of how the loss of the primary producer could cause a decrease in both squirrel and hawk populations.

SCORE POINT 3

10

A) the oak tree transforms solar energy into chemical energy thrugh photosynthesis. This allows water and carbon dioxide to be formed into glucose and later broken up for energy.

B) The hawk is the least efficient at capturing energy because it receives the lowest percentage of energy.

c) Deforestation would result in less squirrels which in turn would result in a reduction in the number of hawks.

The response shows a general understanding of the concepts addressed. Part (a) correctly identifies the oak tree as the primary producer through the function of photosynthesis. Part (b) correctly identifies the hawk as the least efficient in capturing energy. However, the explanation needs to be clearer for full credit. Part (c) provides a correct progression of events but omits some details, such as precisely why deforestation will result in fewer squirrels (less food available); this part is considered general. Both parts (b) and (c) require the reader to infer to complete the response. Overall, this response would need additional details to be considered a score of 4.

SCORE POINT 2

10

A.) The squirrel because it eats from the tree, then gets eaten by the hawk. The squirrel takes the energy of the grown food, then the digesting is done chemicaly.

B.) The hawk is least efficient because it could use more energy trying to capture the squirrel.

C.) With the removal of trees, there's less food and homes, meaning the squirrels lose energy, and when the squirrels lose energy, that means the hawks don't have enough to eat.

The response shows a limited understanding of the concepts addressed. Part (a) is incorrect and receives no credit. Stating that the hawk uses more energy in capturing the squirrel is acceptable for part (b). Part (c) correctly explains the effects on energy flow but does so in general terms.

SCORE POINT 1

10

a) oak tree

b) hawk

c) no more nitrogen fixation

The response shows a minimal understanding of the concepts addressed. The response receives credit for correctly identifying the oak tree as the primary producer in part (a) and the hawk as the least efficient at capturing energy in part (b). Omitting explanations for those parts as well as giving a vague, incorrect explanation in part (c) prevent this response from receiving more than 1 point.

SCORE POINT 0

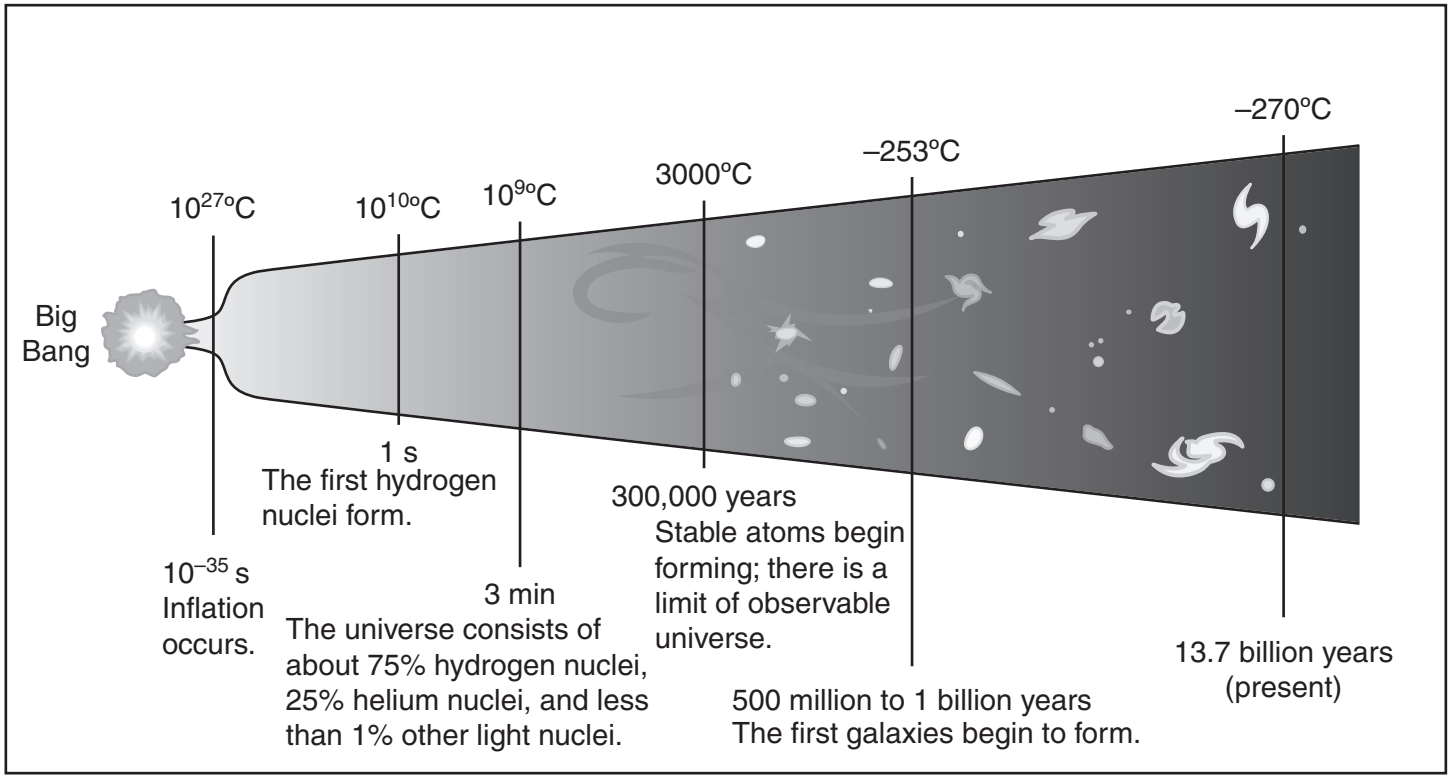
10

The Hawk and squirrel are kind of like the same thing.

The response does not provide any information relevant to the item and receives no credit.

ESS3.6 (9–11) NOS Students will provide scientific evidence that supports or refutes the Big Bang Theory of how the universe was formed.

11 The diagram below shows a time line of the Big Bang Theory.



a. Explain **two** pieces of evidence that support the Big Bang Theory.

b. Explain **two** forces that contribute to the formation of stars and planets.

You may use information from the diagram in your responses.

Scoring Guide

Score	Description
4	Response demonstrates a thorough understanding of the formation of the universe by using data to explain the Big Bang Theory. Response gives the correct conditions before the Big Bang, includes two observations to support the Big Bang Theory, and explains that gravity and nuclear fusion are necessary for the formation of stars and planets. Response includes no errors or omissions.
3	Response demonstrates a general understanding of the formation of the universe by using data to explain the Big Bang Theory. Response has an error or omission.
2	Response demonstrates a limited understanding of the formation of the universe by using data to explain the Big Bang Theory. Response has errors and omissions.
1	Response demonstrates a minimal understanding of the formation of the universe by using data to explain the Big Bang Theory. Response has several errors and omissions.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Training Notes:

a. Support of Big Bang Theory (2 points):

- Galaxies continue to move apart from one another as the universe expands.
- Cosmic microwave background radiation is present.
- An abundance of light elements such as hydrogen, helium, and lithium are present.
- Temperature cools as the universe expands.
- The first galaxies formed 500 million to 1 billion years later.
- Large, stable atoms form as the universe ages.
- Redshifting galaxy spectra are mentioned.

b. Forces for star and planet formation (2 points):

- temperatures of nebulae, clumping due to **gravity**, **pressure** pushing objects apart
- gravity, hydrogen fuses to form helium, nuclear force (nuclear fusion reactions)→ stars
- gravity, collisions of larger and larger particles (planetesimals)→ planets
- electromagnetic force, for assembling planets and stars in connection with friction and pressure

Special Notes:

- Score holistically, with equal weighting for parts (a) and (b).
- Give a total score of 2 out of 4 possible points if lists are given in both parts.

SCORE POINT 4

11

a) By using Orbital telescopes, and spectral lines, we come to the conclusion that since there is a redshift in most of the observed stars + galaxies, the universe is expanding. By using SPITZER (a radio telescope developed by NASA), we can see the spectral emissions released from lightyears away, of very old stars. This allows us to determine the composition of stars near the time period of the Big Bang as well as the presence of the first Hydrogen/Helium stars.

b) First, you would need the raw materials (dust and gas) to form the star. These can usually be found from supernovae. Secondly, you need gravity to pull all of these materials together. After the core temperature rises (through reactions/heat from other stars), Nuclear fusion begins. However, if the dust and gas is heated enough, it may form a planet. This can be proven by looking at our solar system. The terrestrial Planets (Mars, Venus, Mercury, Earth) are rocky due to their proximity to the sun. The jovian planets (Jupiter, Neptune, Saturn, Uranus) are all gaseous planets. This is because the sun's heat could not warm them enough for the necessary reactions to occur,

This is a sophisticated response that presents two pieces of evidence—the redshift and the presence of helium/hydrogen atoms—that support the Big Bang Theory. Both pieces of evidence are well explained and supported with appropriate details. The descriptions supporting the evidence for the formation of stars (gravity and nuclear fusion) are detailed and demonstrated through understanding of the subject matter. Supplemental information that is not required is provided (source of evidence). The response received full credit for both parts and is considered a high 4 score.

SCORE POINT 3 (EXAMPLE A)

11

a the universe is still expanding but it is slowing down
the universe is cooling off slower now; but still cooling
b gravity pulls particles together
nuclear forces fuel the energy needed for a star to burn

The response shows a solid but general understanding of the concepts addressed. Part (a) correctly refers to the continued expansion and cooling of the universe as evidence of the Big Bang. The additional statement that the rate of expansion is slowing down is taken as a minor error. In part (b), the response correctly states that gravity pulls particles together but only implies the progression from individual particles to stars and planets. "Nuclear force," as referred to in the final statement, probably refers to nuclear fusion of hydrogen, but this must be inferred. Also, the explanation refers to a stage later than formation in a star's life. The response could have achieved a score of 4 if not for the minor error in part (a).

SCORE POINT 3 (EXAMPLE B)

11

a. Two pieces of evidence that support the big bang theorey include the red shift and the gradual decrease in tempeture.

b Two forces that contribute the formation of stars and planets are friction and gravity. Gravity allows particles to combine and eventually become planets. The friction of elements after a supernova aids in the creation of a star.

a. cont. The redshift proves the planets are moving away from us due to the doppler effect and a gradual decrease in temperture shows that the bang is losing energy as it continues to expand space.

The response shows a general understanding of the concepts addressed. Part (a) gives two pieces of evidence—the redshift and the universe's decrease in temperature—to support the Big Bang Theory. These phenomena are given support, with the response citing the Doppler shift and the loss of energy as the universe expands. In part (b), credit is given for noting that gravity aids in the formation of planets. References to friction without further explanation receive no credit. Overall, this response presents some accurate information with some strong supporting details, but the presence of general support in some parts and the lack of support in others prevent this response from receiving a score of 4.

SCORE POINT 2

11

a. Temprature have slowly gone downsince the big bang, suggesting there was some type of explosion. Hydrogen atoms formed as the result of nuclear fission

b. Gravity caused matter to form compact balls.

The response shows a limited understanding of the concepts addressed. The response accurately notes that dropping temperatures support the Big Bang Theory. As seen in the item diagram, hydrogen atoms formed, but the response fails to note the abundance of these light elements. Also, the supporting statement citing nuclear fission as the cause of hydrogen formation is not evidence of the Big Bang. Part (b) correctly identifies and explains gravity as a force present during the formation of stars, but the response does not offer a second force. Partial responses are provided for both part (a) and part (b), which earns a score of 2. The score for this response could have been improved by the use of information found in the item diagram.

SCORE POINT 1

11

A). matter and stable atoms

b) gravity. pressure

The response shows a minimal understanding of the concepts addressed. The response correctly states that gravity is a force present during the formation of stars. However, the balance of the information presented is inaccurate or too vague for credit.

SCORE POINT 0

11

A.)

B.) Collision of planets and stars.
explosions of stars.

Part (a) is not attempted and receives no credit. Part (b) vaguely refers to events not related to the formation of stars and planets and receives no credit.